SPONTANEOUS DECOMPOSITION OF EXPLOSIVE GELATINE.

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Several instances of the decomposition of explosive gelatine on keeping or after long exposure to moderate temperatures, have been reported, but I have yet met with but one of these cases in which the products of the decomposition have been stated. Gen. H. L. Abbot, in a prefatory note to Addendum I, Report on Submarine Mines, states that "all the samples of the explosive gelatine remaining on hand after the trials detailed in the Report, have undergone spontaneous decomposition, separating into cellulose and free nitro-glycerine with the copious evolutions of nitrous fumes. This change occurred during the winter and spring of the current year (1881–1882), and was not caused by any exposure to high temperatures while in store."

A case of spontaneous decomposition of a small amount stored freely exposed to the air, in a room of fairly even temperature and dryness, has occurred under my own observation. The camphorated explosive gelatine was wrapped in paraffine paper, and then in light brown Manilla paper, and laid on the shelf. After something more than one year's exposure it was found, in the early winter, to be giving off nitrous fumes (which had stained and attacked the wrapping paper), and to have shrunk considerably in volume, while the outside of the paper was covered with congeries of fine crystals. The odor of camphor was still quite strong. The mass was immediately put into a vessel of water. It was found to be friable, and, after a short immersion, disintegrated. The camphor odor soon disappeared, and the water became of a straw color, gave a strong acid reaction, and showed traces of nitrous acid, but no nitric acid. On evaporation of the filtered liquid, oxalic acid crystallized out in quantity, and on evaporation of the "mother liquor" on the water bath, a sugar-like mass was obtained, which gave the glucose reaction with Fehling's solution. The paraffine was regained unchanged, and the paper was recovered, but in a flocculent condition, and with the color bleached from the brown. Careful search failed to reveal the presence of glycerine, nitro-glycerine, or gun-cotton. The cellulose from the gun-cotton could not well be detected (if it existed) in the presence of so much flocculent cellulose from the paper. In reporting these observations I am not unmindful of the fact that some changes may have taken place during immersion, but it can easily be understood why I preferred it in that position.

The results obtained by de Luca in his "Researches on the Spontaneous Decomposition of Gun-Cotton," *Comptes Rendus* 59,487, *Sept.* 12, 1847, are interesting in this connection. Gun-cotton decomposes most rapidly when heated to 50° on a water bath, next by direct sunlight, more slowly by diffused light, and very slowly in darkness. The gun-cotton first shrinks to one-tenth of its original volume, next it begins to become gum-like and sticky, then it swells; during all these phases it gives off nitrous fumes, but especially during the last. For the fourth phase the gas ceases to be evolved, and the mass becomes brittle, and of a light color like sugar. The products are nitrous compounds, with formic and acetic acids in the state of a gas, and an amorphous, porous, sugar-like body, almost entirely soluble in water, and containing an abundance of glucose, gummy matter, oxalic acid, a small quantity of formic acid, and a new acid of which he obtained the lead and silver salts for later examination. From 100 grains of gun-cotton he obtained about 14 grains of glucose.

In discussing the stability of nitro-glycerine (which is the other component of explosive gelatine), A. Brull, in *Etudes sur la Nitro-glycérine et la Dynamite*, *fig.* 26, 1875, says: "Nitro-glycerine which retains traces of acid is not stable. In general the decomposition is extremely slow and tranquil. It disengages at first nitrous fumes, and the liquid takes a greenish color; then it generates nitrogen protoxide, carbon dioxide and crystals of oxalic acid, and after some months the entire mass is found to be converted into a greenish, gelatinous mass, composed of oxalic acid, water, and ammonia. Sometimes, if the temperature is quite high—if for example, the nitro-glycerine is heated by the sun, the decomposition is more active. Very rarely it causes an explosion."

The source of difficulty, then, seems to be in the presence of free acid, and this will probably be found in the gun-cotton used, for it is difficult to purify soluble gun-cotton completely.